



NASA STTR 2017 Phase I Solicitation

T6.01 Closed-Loop Living System for Deep-Space ECLSS with Immediate Applications for a Sustainable Planet

Lead Center: ARC

Participating Center(s): MSFC

Technology Area: TA6 Human Health, Life Support and Habitation Systems

NASA's plans to explore space beyond Low Earth Orbit will push the performance of life support systems toward closed loop living systems. Deep space missions will require life support systems that will be self-sustaining since we cannot expect to carry enough spares and consumables for year-long missions. Achieving the development of such systems will provide the understanding for managing the limited availability of resources. The parallel with earth planetary resources management is useful as the world population grows and resources and infrastructure availability decreases. We anticipate that technologies developed for closed loop living systems could be made available to provide near term planetary sustainability as well.

State of the Art

An immediate example of such endeavors exists in the form of the NASA Ames Sustainability Base where technologies for deep space exploration have been used to create one of the greenest buildings in the federal building inventory. These technologies include power generation with fuel cells, water recovery systems, advanced HVAC, automated environmental control, recyclable materials and use of local resources. Even though these technologies are readily available for deep space travel, each has its own set of challenges for adaption to earth application along with integration challenges.

Closed-loop living systems are based on the thermodynamics laws of the conservation of mass and energy. We hope to maximize the conservation so that only a minimal amount of spare resources needs to be taken on crewed deep space missions.

Innovations are sought to enable:

- Development of processes and technologies to allow for closed loop living applications in space and on earth.
- Transfer of advanced deep space life support technologies and systems to earth based applications.
- Development of viable off-the-grid habitation in remote areas where infrastructure is inexistent.

Potential deliverables include a demo of ECLSS concept(s), enhanced process and control techniques for multiple life support subsystems (e.g., environment, water recovery, power usage, etc.), or prototype(s) of relevant hardware and/or software.

For integrated system health management and monitoring capabilities that support sustainable systems,

respondents are encouraged to consider SBIR subtopic - H6.01.